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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/752,642	01/07/2004	Naofumi Nakamura	790001-2042	4109
20999 7590 11/30/2007 FROMMER LAWRENCE & HAUG 745 FIFTH AVENUE- 10TH FL. NEW YORK, NY 10151			EXAMINER CHU, CHRIS C	
			ART UNIT 2815	PAPER NUMBER
			MAIL DATE 11/30/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/752,642	Applicant(s) NAKAMURA ET AL.	
	Examiner Chris C. Chu	Art Unit 2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 September 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 - 14 is/are pending in the application.
- 4a) Of the above claim(s) 5 - 10, 13 and 14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 - 3, 11 and 12 is/are rejected.
- 7) ☒ Claim(s) 4 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Request for Continued Examination

1. A request for continued examination (RCE) under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 2, 2007 has been entered. An action on the RCE follows.

Response to Amendment

2. Applicant's amendment filed on July 17, 2007 has been received and entered in the case.

Election/Restrictions

3. Applicant's election with traverse of Species I in the reply filed on September 18, 2007 is acknowledged. The traversal is on the ground(s) that a single search can be performed for all species of claims without any significant burden on the Office. This is not found persuasive because the search may overlap but the examination of two distinct inventions is where the burden lies. Examination includes much more than just searching. Since the each invention requires separate examination and search, the restriction is still generally deemed to be proper.

Furthermore, applicant argues “claim 9 links the groups of claims 1, 5, 7 and 11, and provides a basis for search and examination of all embodiments without any undue burden.” This argument is not persuasive because claim 1 is not the necessary middle product to form the claim 9. For example, the product as claimed in claim 9 can be made by materially different material such as the via contact contains at least two additives which include an additive which is the same as that contained in the metal wiring materials of the at least two wiring layers. However, claim 1’s wiring layers do not contain any additives. Therefore, claim 1 is not linked to claim 9.

The requirement is still deemed proper and is therefore made FINAL.

Drawings

4. Figures 23 – 25 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1 – 3, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chan et al. (U. S. Pat. No. 6,468,906) in view of Jan (U. S. Pat. No. 6,861,758).

Regarding claim 1, Chan et al. discloses in e.g., Fig. 1F a semiconductor device (10; column 2, line 47) having a multilayer structure (see e.g., Fig. 1F), comprising:

- at least two wiring layers (16 and 24; column 2, line 64 and column 3, line 61), each formed in a wiring groove formed in a corresponding insulating film (12 and 20; column 2, line 56 and column 3, line 29); and
- a via contact (the via contact that is formed in the layer 18) embedded, in a via hole (the via that is formed in the layer 18) formed in an insulating film (18; column 3, line 22) formed between the at least two layers (16 and 24) and made of a metal wiring material which is the same as that of the at least two wiring layers (16 and 24; column 2, line 64, column 3, line 61 and see e.g., Fig. 1F).

Chan et al. does not disclose an additive within the metal wiring material of the via contact. Jan teaches in e.g., Fig. 9 a metal wiring material (the material that is located between the elements 132 and 142, i.e., 144; column 4, lines 31 – 47 and column 2, lines 49 – 51) of the via contact (the via between the elements 142 and 132) containing an additive (the dopant material; column 2, lines 45 – 46) which is not contained in the metal wiring materials of the at least two wiring layers (132 and 142). It would have been obvious to one of ordinary skill in the art at the time when the invention was made to apply the dopant material of Jan as the specific

material to form the additive within the metal wiring material of the via contact of Chan et al. as taught by Jan to inhibit electromigration (column 3, lines 1 – 12).

Regarding claims 2 and 12, Chan et al., as modified, discloses in e.g., Fig. 1F the metal wiring material (132 and 142 and/or 16 and 24) being Cu (column 2, lines 45 – 47 and/or column 2, line 64 and column 3, line 61) and the additive (the dopant material) being Sn, Rh, Zn, Al, Ru, Cr, Pd, In, Mg, Co, Zr, Ti, Ag, Ir, Ni, Ge, Nb, B, Or Hr (column 2, lines 49 – 51).

Regarding claim 3, Chan et al., as modified, discloses in e.g., Fig. 1F the metal wiring material (132 and 142 and/or 16 and 24) being Al (column 2, lines 45 – 47 and/or column 4, lines 59 – 61) and the additive (the dopant material) being Cu or Si (column 2, lines 49 – 51).

Regarding claim 11, Chan et al. discloses in e.g., Fig. 1F a semiconductor device (10) comprising:

- a first metal wiring layer (16) made of a first wiring material (column 2, lines 45 – 47), formed in a first wiring groove formed in a first insulating film (12) on a semiconductor substrate (the semiconductor substrate of the semiconductor device 10; column 2, lines 53 – 59);
- a second insulating film (18) on the first insulating film (12) having the first wiring layer (16) embedded therein (see e.g., Fig. 1F);
- a via contact (the via contact that is formed in the layer 18) embedded in a via hole (the via that is formed in the layer 18) formed in the second insulating film, the via contact (the via contact that is formed in the layer 18) being made of the same wiring material as the first wiring material (column 2, line 64, column 3, line 61 and see e.g., Fig. 1F);

- a third insulating film (20) on the second insulating film (20) having the via contact formed therein (see e.g., Fig. 1F); and
- a second metal wiring layer (24) embedded in a second wiring groove (the opening within the layer 20) formed in the third insulating film (20; see e.g., Fig. 1F), the second metal wiring layer (24) being made of the same metal wiring material as the metal wiring material of the first metal wiring layer (16; column 2, line 64, column 3, line 61 and see e.g., Fig. 1F).

Chan et al. does not disclose an additive within the metal wiring material of the via contact. Jan teaches in e.g., Fig. 9 a metal wiring material (the material that is located between the elements 132 and 142, i.e., 144; column 4, lines 31 – 47 and column 2, lines 49 – 51) of the via contact (the via between the elements 142 and 132) containing an additive (the dopant material; column 2, lines 45 – 46) which is not contained in the metal wiring materials of the at least two wiring layers (132 and 142). It would have been obvious to one of ordinary skill in the art at the time when the invention was made to apply the dopant material of Jan as the specific material to form the additive within the metal wiring material of the via contact of Chan et al. as taught by Jan to inhibit electromigration (column 3, lines 1 – 12).

Allowable Subject Matter

7. Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(A) Claim 4 contains allowable subject matter because none of references of record teach or suggest, either singularly or in combination, at least the limitation of a metal wiring material being Ag and the additive being Cu.

Response to Arguments

8. Applicant's arguments with respect to claims 1 and 11 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Iino et al., Liu et al., Li et al., Higashi et al., Graas, Halliyal et al., Huang et al. and Young disclose multi-layer metal interconnect structure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chris C. Chu whose telephone number is 571-272-1724. The examiner can normally be reached on 11:30 - 8:00.

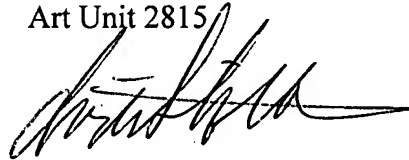
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Chris C. Chu
Examiner
Art Unit 2815



c.c.

Wednesday, November 28, 2007